

## REMARKS

This is intended as a full and complete response to the Office Action dated October 31, 2005, having a shortened statutory period for response set to expire on January 31, 2006.

## DRAWINGS

The drawings are objected to under 37 CFR 1.83(a). The Examiner states that drawings must show every feature that is claimed. The Examiner further states that the references "QT" and "OT" in the paragraph starting at line 1, page 6 must be shown or the feature(s) canceled from the claim(s). The reference to "OT" is a typographical error, and should read "QT". The subject paragraph has been amended correcting this typographical error. The reference "QT" is shown conceptually in Fig. 1 as an output from the quad temperature oscillator 16. The reference "QT" has not been used in any claim language.

## CLAIMS

### CLAIM OBJECTION

The informality cited in claim 22 has been corrected in the amendment of claim 22.

### REJECTION UNDER 35 U.S.C. § 102

Claims 11 and 32 stand rejected under 35 U.S.C. § 102(a) as being anticipated by U.S. Patent No. 5,250,871 to Driscoll et al (*Driscoll*).

*Driscoll* discloses a quad compensated clock comprising four oscillator crystals electrically connected in series and with their sensitivity vectors aligned, nominally one per quadrant, in a common plane. The crystals are configured pairs so that maximum acceleration vectors of the oscillators comprising the pairs are in opposite directions. Outputs from the crystals are input into an oscillator circuit to form a quad compensated clock output with reduced sensitivity to acceleration. *Driscoll* does not teach correction of the clock output for any variations in crystal properties. No hardware or software for such corrections is disclosed.

The instant invention teaches a quad compensated clock comprising a quad compensated resonator comprising four oscillator crystals that are electrically connected in series with their acceleration sensitivity vectors aligned, nominally one per quadrant, in a common plane. The crystals are configured in pairs so that maximum acceleration sensitivity vectors of oscillators comprising the pairs are in opposite directions. Oscillator circuitry cooperates with the quad compensated resonator. Outputs of the oscillator crystals in the quad compensated resonator are combined and input into oscillator circuitry to form a quad compensated clock output with reduced sensitivity to acceleration. During a predetermined time interval "J" (see specification page 13, line 13

following), the quad compensated clock output is combined with output from a quad compensated temperature sensor using a compensation algorithm. The compensation algorithm is resident in a processor cooperating with the clock, and is used to correct the compensated clock output for variations in crystal properties. As mentioned above, *Driscoll* does not teach correction of clock output for any type of crystal property variation. More specifically, *Driscoll* does not disclose processing of data over a predetermined time interval, does not disclose a temperature sensor or temperature measurement of any type, and does not disclose a processor and a related algorithm used to correct clock output for variations in crystal properties other than that induced by acceleration.

Claims 11 and 32 have been amended to recite that during a predetermined time interval, the quad compensated clock output is combined with output from a quad compensated temperature sensor using a compensation algorithm resident in a processor, cooperating with the clock, to correct the clock output for variations in crystal properties. Amended claims 11 and 32 are distinguished over *Driscoll*. In view of the claim amendments and the above discussion, the examiner is respectfully requested to reconsider rejections of claims 11 and 32 under 35 U.S.C. § 102(a)

#### REJECTION UNDER 35 U.S.C. § 103

Claims 12 and 33 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Driscoll* in view of applicant's admission.

As discussed above, *Driscoll* does not teach or suggest a processor and a compensation algorithm for compensating clock output for variations in crystal properties. In view of the above discussion and amendments, claims 11 and 32 are patentable over *Driscoll* in view of applicant's admission. Claims 12 and 33, which depend upon claims 11 and 32, respectively, are also patentable over *Driscoll* in view of applicant's admission. The Examiner is respectfully requested to reconsider rejection of claims 12 and 33 under 35 U.S.C. § 103(a).

Claims 13 and 34 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Driscoll* in view of Application US 2002/0173284 A1 to Forrester (*Forrester*).

*Driscoll* discloses a quad compensated clock comprising four oscillator crystals electrically connected in series and with their sensitivity vectors aligned, nominally one per quadrant, in a common plane. The crystals are configured pairs so that maximum acceleration vectors of the oscillators comprising the pairs are in opposite direction. Outputs from the crystals are input to an oscillator circuit to form a quad compensated clock output with reduced sensitivity to acceleration. *Driscoll* does not teach or suggest correction of the clock output for any variations in crystal properties.

*Forrester* teaches correction of an oscillator output for variations in crystal properties. Corrections are controlled by changes in temperature (as examples, see page 3, paragraph [0035] and Figs. 1 and 2 with related discussion).

The instant invention uses a measure of temperature in determining clock output for variations in crystal properties. The correction process of the instant invention is, however time interval controlled. As discussed above, during a predetermined time

interval "J" (see specification page 13, line 13 through page 14), the quad compensated clock output is combined with output from a quad compensated temperature sensor using a compensation algorithm, resident in a processor cooperating with the clock, to correct the clock output for variations in crystal properties. No combination of *Driscoll* and *Forrester* teaches or suggests a time interval based clock output method. No combination would provide means for making such corrections. Furthermore, any hypothetical combination of *Driscoll* and *Forrester* would teach away from the instant invention by utilizing temperature variation rather than a predetermined time interval to initiate clock output correction.

In view of the above discussion, amended claims 11 and 32 are patentable over *Driscoll* in view of *Forrester*. Claims 13 and 34, which depend upon claims 11 and 32 respectfully, are also patentable over *Driscoll* in view of *Forrester*. The Examiner is respectfully requested to reconsider the rejection of claims 13 and 34 under 35 U.S.C. § 103(a).

Claims 14 and 35 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Driscoll* in view of Application US 2002/0060952 A1 to Cecconi (*Cecconi*).

*Driscoll* discloses a quad compensated clock comprising four oscillator crystals electrically connected in series and with their sensitivity vectors aligned, nominally one per quadrant, in a common plane. *Driscoll* does not teach correction of the clock output for any variations in crystal properties other than those induced by acceleration. *Driscoll* discloses no type of temperature measuring apparatus or methodology.

*Cecconi* discloses a borehole seismic system. The *Cecconi* system includes a downhole clock comprising a quartz crystal. In order to minimize clock drift, the clock cooperates with a temperature control means (heating or alternately cooling). Both the quartz crystal and the temperature control means are disposed within thermal insulation. This methodology is used to maintain the quartz crystal at a constant temperature while operating in a borehole, therefore minimizing temperature induced clock output drift.

As discussed previously, the instant invention uses a measure of temperature in correcting clock output for variations in crystal properties. No temperature control means is taught or needed to correct clock output for adverse effects of temperature variations. The correction process of the instant invention does, however, use a measure directly related to temperature. More specifically, the response of the quad compensated temperature sensor is used in the clock correction methodology. The quad compensated clock output is combined with output from a quad compensated temperature sensor using a compensation algorithm, resident in a processor cooperating with the clock, to correct the compensated clock output for variations in crystal properties. No combination of *Driscoll* and *Cecconi* teaches or suggests a system that uses a measure of temperature to correct clock output for temperature variations of crystal properties.

In view of the above discussion, amended claims 11 and 32 are patentable over *Driscoll* in view of *Cecconi*. Claims 14 and 35, which depend upon claims 11 and 32, respectfully, are also patentable over *Driscoll* in view of *Cecconi*. The Examiner is respectfully requested to reconsider the rejection of claims 14 and 35 under 35 U.S.C. § 103(a).

Claim 22 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over *Driscoll*. *Driscoll* does not teach the use of an ensemble of quad compensated clocks.

The Examiner states that mere duplication of parts is not sufficient to patentably distinguish any invention over prior art. See MPEP § 2144.44(VI)(B). Claim 22 has been amended to recite at element (d) the step of correcting the quad compensated clock output for changes in response properties of the crystals. No mere duplication parts of *Driscoll* would provide means for performing this step. Amended claim 22 is now patentable over *Driscoll*.

### **ALLOWABLE MATERIAL**

The examiner states that claims 23-31 are objected to as being dependent upon rejected claim 22, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim 23 has been amended as an independent claim including all limitations of the base claim 22 as originally filed. Claims 24-31 depend upon claim 23. The Examiner's criteria for allowance of claims 23-31 have been met, and the Examiner is respectfully requested to allow claims 23-31.

### **SUMMARY**

In view of the above amendments and discussion, the Examiner is respectfully requested to allow claims 11-14, 22-31 and 32-35.

### **ELECTION/RESTRICTIONS**

The Office Action Summary with a mail date of October 31, 2005 indicates that claims 1 – 35 are pending in the instant application and that claims 1 – 10 and 15 – 21 are withdrawn. It should be noted that the application as filed included claims 1 – 42 as confirmed in the office communication dated July 1, 2005 and that claims 1 – 10, 15 – 21 and 36 – 42 were withdrawn from consideration in Applicant's response filed July 11, 2005.